CLAIMS

1. A method of forming an opening through a substrate, the method comprising:

etching into the substrate from a first side, including forming a first portion of the opening;

etching into the substrate from a second side opposite the first side, including forming a second portion of the opening;

continuing etching into the substrate from at least one of the first side and the second side toward the other of the first side and the second side, including communicating the first portion and the second portion of the opening; and

etching into the substrate from an interface between the first portion and the second portion of the opening, including etching toward the second side of the substrate and forming a third portion of the opening.

2. The method of claim 1, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes etching toward the second side of the substrate at an angle to the second side of the substrate.

3. The method of claim 2, wherein the angle is non-parallel and non-orthogonal to the second side of the substrate.

4. The method of claim 1, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes etching along at least one side of the second portion of the opening.

5. The method of claim 1, wherein forming the third portion of the opening includes forming a compound surface between the first portion and the second portion of the opening.

6. The method of claim 1, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes etching toward the first side of the substrate.

7. The method of claim 6, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes etching toward the first side of the substrate at an angle to the first side of the substrate.

8. The method of claim 7, wherein the angle is non-parallel and non-orthogonal to the first side of the substrate.

9. The method of claim 6, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes etching along at least one side of the first portion of the opening.

10. The method of claim 1, wherein forming the first portion of the opening includes converging the first portion of the opening from the first side toward the second side of the substrate, wherein forming the second portion of the opening includes converging the second portion of the opening from the second side toward the first side of the substrate, and wherein forming the third portion of the opening includes diverging the opening from the second side toward the first side of the substrate.

11. The method of claim 1, wherein forming the third portion of the opening includes, in a first direction, diverging the opening from the second side toward the first side of the substrate and, in a second direction, converging the opening from the second side toward the first side of the substrate.

12. The method of claim 1, wherein the substrate is a silicon substrate, and wherein etching into the substrate from the first side includes etching along a first crystalline plane of the silicon substrate, etching into the substrate from the

second side includes etching along a second crystalline plane of the silicon substrate, and etching into the substrate from the interface between the first portion and the second portion of the opening includes etching along a third crystalline plane of the silicon substrate.

13. The method of claim 12, wherein the first crystalline plane, the second crystalline plane, and the third crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate.

14. The method of claim 13, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate.

15. The method of claim 12, wherein the first crystalline plane and the second crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate and the third crystalline plane of the silicon substrate is a high-index plane of the silicon substrate.

16. The method of claim 15, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate and the high-index plane of the silicon substrate includes a non-binary plane of the silicon substrate.

17. The method of claim 1, wherein etching into the substrate from the first side includes anisotropically wet etching into the substrate.

18. The method of claim 1, wherein etching into the substrate from the second side includes anisotropically wet etching into the substrate.

19. The method of claim 1, wherein etching into the substrate from the interface between the first portion and the second portion of the opening includes anisotropically wet etching into the substrate.

20. A method of forming a substrate for a fluid ejection device, the method comprising:

etching a first portion of a fluidic channel into the substrate from a first side;

etching a second portion of the fluidic channel into the substrate from a second side opposite the first side;

continued etching of at least one of the first portion and the second portion of the fluidic channel to the other of the first portion and the second portion of the fluidic channel; and

overetching the second portion of the fluidic channel from an interface between the first portion and the second portion of the fluidic channel, including etching toward the second side of the substrate.

21. The method of claim 20, wherein overetching the second portion of the fluidic channel includes etching from the interface between the first portion and the second portion of the fluidic channel toward the second side of the substrate at an angle.

22. The method of claim 21, wherein the angle is non-parallel and non-orthogonal to the second side of the substrate.

23. The method of claim 20, wherein overetching the second portion of the fluidic channel includes overetching at least one side of the second portion of the fluidic channel.

24. The method of claim 20, wherein overetching the second portion of the fluidic channel includes forming a compound surface along at least one side of the second portion of the fluidic channel.

25. The method of claim 20, wherein overetching the first portion of the fluidic channel from the interface between the first portion and the second portion of the fluidic channel includes etching toward the first side of the substrate.

26. The method of claim 25, wherein overetching the first portion of the fluidic channel includes etching from the interface between the first portion and the second portion of the fluidic channel toward the first side of the substrate at an angle.

27. The method of claim 26, wherein the angle is non-parallel and non-orthogonal to the first side of the substrate.

28. The method of claim 25, wherein overetching the first portion of the fluidic channel includes overetching at least one side of the first portion of the fluidic channel.

29. The method of claim 20, wherein etching the first portion of the fluidic channel includes converging the first portion of the fluidic channel from the first side toward the second side of the substrate, wherein etching the second portion of the fluidic channel includes converging the second portion of the fluidic channel from the second side toward the first side of the substrate, and wherein overetching the second portion of the fluidic channel includes diverging the second portion of the fluidic channel from the second side toward the first side of the substrate.

30. The method of claim 20, wherein overetching the second portion of the fluidic channel includes, in a first direction, diverging the second portion of the fluidic channel from the second side toward the first side of the substrate and, in a second direction, converging the second portion of the fluidic channel from the second side toward the first side of the substrate.

31. The method of claim 20, wherein the substrate is a silicon substrate, and wherein etching the first portion of the fluidic channel includes etching along a first crystalline plane of the silicon substrate, etching the second portion of the fluidic channel includes etching along a second crystalline plane of the silicon

substrate, and overetching the second portion of the fluidic channel includes etching along a third crystalline plane of the silicon substrate.

32. The method of claim 31, wherein the first crystalline plane, the second crystalline plane, and the third crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate.

33. The method of claim 32, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate.

34. The method of claim 31, wherein the first crystalline plane and the second crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate and the third crystalline plane of the silicon substrate is a high-index plane of the silicon substrate.

35. The method of claim 34, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate and the high-index plane of the silicon substrate includes a non-binary plane of the silicon substrate.

36. The method of claim 20, wherein etching the first portion of the fluidic channel includes anisotropically wet etching into the substrate from the first side.

37. The method of claim 20, wherein etching the second portion of the fluidic channel includes anisotropically wet etching into the substrate from the second side.

38. The method of claim 20, wherein overetching the second portion of the fluidic channel includes anisotropically wet etching from the interface between the first portion and the second portion of the fluidic channel.

39. The method of claim 20, wherein continued etching of the at least one of the first portion and the second portion of the fluidic channel includes

communicating the first portion and the second portion of the fluidic channel and forming the interface between the first portion and the second portion of the fluidic channel.

40. A substrate for a fluid ejection device, the substrate comprising:

a first side;

a second side opposite the first side; and

a fluidic channel communicating with the first side and the second side,

wherein a first portion of the fluidic channel extends from the first side toward the second side, a second portion of the fluidic channel extends from the second side toward the first side, and a third portion of the fluidic channel extends from an interface between the first portion and the second portion of the fluidic channel toward the second side.

41. The substrate of claim 40, wherein the third portion of the fluidic channel extends from the interface between the first portion and the second portion of the fluidic channel toward the first side.

42. The substrate of claim 40, wherein the third portion of the fluidic channel extends between the second portion of the fluidic channel at the second side and the first portion of the fluidic channel.

43. The substrate of claim 40, wherein the third portion of the fluidic channel extends from at least one side of the second portion of the fluidic channel.

44. The substrate of claim 43, wherein the third portion of the fluidic channel extends from two opposing sides of the second portion of the fluidic channel.

45. The substrate of claim 40, wherein the third portion of the fluidic channel includes a compound surface extending between the first portion and the second portion of the fluidic channel.

46. The substrate of claim 40, wherein the first portion of the fluidic channel has a substantially triangular-shaped cross-section, wherein the second portion of the fluidic channel has a substantially triangular-shaped cross-section, and wherein the third portion of the fluidic channel has a substantially diamond-shaped cross-section.

47. The substrate of claim 46, wherein the substantially diamond-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.

48. The substrate of claim 40, wherein the first portion of the fluidic channel converges from the first side toward the second side, wherein the second portion of the fluidic channel converges from the second side toward the first side, and wherein the third portion of the fluidic channel diverges from the second side toward the first side.

49. The substrate of claim 40, wherein, in a first direction, the third portion of the fluidic channel diverges from the second side toward the first side and, in a second direction, the third portion of the fluidic channel converges from the second side toward the first side.

50. The substrate of claim 40, wherein the first portion of the fluidic channel is etched into the first side toward the second side, the second portion of the fluidic channel is etched into the second side toward the first side, and the third portion of the fluidic channel is etched from the interface between the first portion and the second portion of the fluidic channel toward the second side.

51. The substrate of claim 50, wherein the third portion of the fluidic channel is etched at an angle which is non-parallel and non-orthogonal to the second side.

52. The substrate of claim 50, wherein the first portion of the fluidic channel is anisotropically wet etched into the first side toward the second side.

53. The substrate of claim 50, wherein the second portion of the fluidic channel is anisotropically wet etched into the second side toward the first side.

54. The substrate of claim 50, wherein the third portion of the fluidic channel is anisotropically wet etched from the interface between the first portion and the second portion of the fluidic channel toward the second side.

55. The substrate of claim 40, wherein the substrate is a silicon substrate, wherein the first portion of the fluidic channel is formed along a first crystalline plane of the silicon substrate, the second portion of the fluidic channel is formed along a second crystalline plane of the silicon substrate, and the third portion of the fluidic channel is formed along a third crystalline plane of the silicon substrate.

56. The substrate of claim 55, wherein the first crystalline plane, the second crystalline plane, and the third crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate.

57. The substrate of claim 56, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate.

58. The substrate of claim 55, wherein the first crystalline plane and the second crystalline plane of the silicon substrate are each a low-index plane of the silicon substrate and the third crystalline plane of the silicon substrate is a high-index plane of the silicon substrate.

59. The substrate of claim 58, wherein the low-index plane of the silicon substrate includes a binary plane of the silicon substrate and the high-index plane of the silicon substrate includes a non-binary plane of the silicon substrate.

60. A substrate for a fluid ejection device, the substrate comprising:

a first side;

a second side opposite the first side; and

a fluidic channel communicating with the first side and the second side, wherein a first portion of the fluidic channel converges from the first side toward the second side, a second portion of the fluidic channel converges from the second side toward the first side, and a third portion of the fluidic channel diverges from the second side toward the first side.

61. The substrate of claim 60, wherein the third portion of the fluidic channel diverges from the second side toward the first side in a first direction and converges from the second side toward the first side in a second direction.

62. The substrate of claim 60, wherein the first portion of the fluidic channel has one of a substantially triangular-shaped cross-section and a substantially trapezoidal-shaped cross-section, wherein the second portion of the fluidic channel has one of a substantially triangular-shaped cross-section and a substantially trapezoidal-shaped cross-section, and wherein the third portion of the fluidic channel has one of a substantially diamond-shaped cross-section and a substantially trapezoidal-shaped cross-section.

63. The substrate of claim 62, wherein the one of the substantially diamond-shaped cross-section and the substantially trapezoidal-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.

64. The substrate of claim 60, wherein the first portion of the fluidic channel has a substantially triangular-shaped cross-section, wherein the second portion of the fluidic channel has a substantially triangular-shaped cross-section, and wherein the third portion of the fluidic channel has a substantially diamond-shaped cross-section.

65. The substrate of claim 64, wherein the substantially diamond-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.

66. The substrate of claim 60, wherein the first portion of the fluidic channel has a substantially triangular-shaped cross-section, wherein the second portion of the fluidic channel has a substantially triangular-shaped cross-section, and wherein the third portion of the fluidic channel has a substantially trapezoidal-shaped cross-section.

67. The substrate of claim 66, wherein the substantially trapezoidal-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.

68. The substrate of claim 60, wherein the first portion of the fluidic channel has a substantially trapezoidal-shaped cross-section, wherein the second portion of the fluidic channel has a substantially trapezoidal-shaped cross-section, and wherein the third portion of the fluidic channel has a substantially diamond-shaped cross-section.

69. The substrate of claim 68, wherein the substantially diamond-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.

70. The substrate of claim 60, wherein the first portion of the fluidic channel has a substantially trapezoidal-shaped cross-section, wherein the second portion of the fluidic channel has a substantially trapezoidal-shaped cross-section, and

wherein the third portion of the fluidic channel has a substantially trapezoidal-shaped cross-section.

71. The substrate of claim 70, wherein the substantially trapezoidal-shaped cross-section of the third portion of the fluidic channel diminishes in size from the second portion of the fluidic channel toward an end of the first portion of the fluidic channel.